

## ABSTRACT

A microelectromechanical systems (MEMS) and integrated circuit (IC) based biosensor capable of sensing or detecting various ionic molecules and macromolecules (DNA, RNA or protein). The MEMS based biosensor utilizes a hybridization and enzyme amplification scheme and an electrochemical detection scheme for sensitivity improvement and system miniaturization. The biosensor or biosensors are incorporated on a single substrate. Preferably, the biosensor system includes at least two electrodes. The electrodes includes a working electrode, a reference electrode and a counter (auxiliary) electrode. The biosensor or biosensors also provide an apparatus and method for confinement of reagent and/or solution in the biosensor or biosensors using surface tension at small scale. The confinement system provides controlled contacts between the reagent(s) and/or solution(s) with the components (i.e., electrodes) of the biosensor or biosensors using controllable surface properties and surface tension forces. The confinement system allows for incorporation of the biosensor or biosensors into a portable or handheld device and is immune to shaking and/or flipping. The invention also provides for a biosensor and/or sensors that are integrated with integrated circuit (IC) technologies. Preferably, the entire sensor system or systems are fabricated on a single IC substrate or chip and no external component and/or instrument is required for a complete detection system or systems. Preferably, the sensor system or systems are fabricated using the IC process and on a silicon substrate.